Laser ablation dynamics and production of thin films of lysozyme

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Abstract: Laser ablation dynamics and production of thin films of lysozyme

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(3)National Institute for Lasers, Plasma and Radiation Physics, RO-077125 Magurele-Bucharest, Romania Lysozyme is a well-known protein, which is used in food processing because of its bactericidal properties. The mass (14307 amu) is in the range in which it easily can be monitored by mass spectrometric methods, for example by MALDI (Matrix assisted laser desorption ionization). We have recently produced thin films of average thickness up to 300 nm, which not only contained a significant amount of intact molecules, but also maintained the bioactivity. These films were produced by a nanosecond laser in the UV regime at 355 nm with 2 J/cm^2. The surprising fact that these molecules can be transferred to a substrate as intact molecules by the violent laser impact (~up to 50 mJ/pulse) has not yet been understood. One issue is that up to 150 ng/pulse is removed by the laser, and much of the material is ejected from the target in relatively large chunks.

We have explored as well the excitation mechanics by laser impact. Samples of pressed lysozyme prepared in the same manner as in ns-experiments have been irradiated at 527 nm with 300-fs pulses and at at similar fluence as in ns ablation. Even though the pulse energy was much smaller, there was a considerable ablation weight loss of lysozyme from each shot. This is the first time the ablation by fs-lasers of a protein has been recorded quantitatively. Films of lysozyme produced by fs-laser irradiation were analyzed by MALDI and a significant number of intact molecules in the films with fs-laser deposition was found as well.